

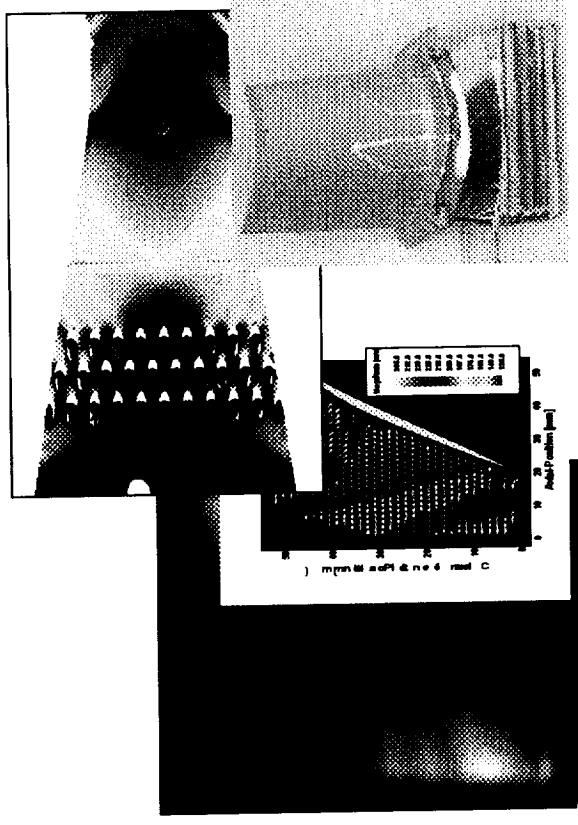
54/CP/1N/35

## Information Rich Test Instrumentation

Carolyn Mercer, GRC 216-433-3411

Gary Hunter, GRC, 216-433-6459

New project to  
Develop ground test  
instrumentation for 3<sup>rd</sup>  
Generation Engine tests



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## Information Rich Test Instrumentation

## Participants in Planning Process

### Technical Working Group:

Carolyn Mercer, Instrumentation, GRC  
Gary Hunter, Sensors, GRC  
Kevin Breisacher, Combustion, GRC  
Gerry Nissen, Sensors, Boeing  
Joel McManus, Sensors, Boeing  
Dick Greenhalgh, Rockets, P&W  
W.T. Powers, Instrumentation, MSFC  
Bob Truesdale, Solid Rockets, AEDC

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Gregory A. Hall, Space Transportation, KSC  
Don Gardner, Instrumentation, AEDC  
William Mouyos, Sensors, Lockheed Sanders  
Bill St. Cyr, SSC

### Proposals by:

Mike Marcolini, Instrumentation, LaRC  
Glenn Diskin, Hypersonics, LaRC  
Bob Rogowski, NDE, LaRC  
Jih-Fen Lei, Instrumentation, GRC

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W.T. Powers, Avionics, MSFC  
Ravi Mehta, Instrumentation, ARC

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# Information Rich Test Instrumentation

## **GOALS**

- Increase safety by understanding operating conditions and component capabilities
- Reduce development and operating costs by:
  - Reducing testing and design cycle times and
  - Reducing engine weight and increasing component life

## **OBJECTIVES**

- Determine cooling system effectiveness
- Determine structural loads

## **TECHNICAL CHALLENGES**

- 2000 deg F surfaces; 8000 deg F flows; up to Mach 11
- Remote signal extraction
- Ultra-low intrusive measurements

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# **Information Rich Test Instrumentation**

## Technologies targeted and selected to address objectives

Objectives	Technologies				
	Thin Films/MEMS	Phosphor Paints	Spectroscopy	Velocimetry	
Cooling System					
Surface Temp	○	○			
Surface Heat Flux	○				
Gas Temp			○		
Combustion	○		○		
Weight					
Surface strain	○				
CFD validation					
Velocity				○	
Temperature	○	○	○		

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# Information Rich Test Instrumentation

## Tasks awarded for FY01:

- Micro-fabricated multifunctional smart sensor system for harsh environments (*surface heat flux, temperature, strain, vibration*) GRC
- High temperature surface measurements using thermographic phosphors (*surface temperature, heat flux*) GRC + Oak Ridge National Labs
- Flow temperature profiling using smart particles imaging technology (*gas temperature*) LaRC + GRC
- Embedded, integrated, high frequency response, multi-plane velocimetric system for aeropropulsion systems (*gas velocity*) LaRC + GRC

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# Information Rich Test Instrumentation

## **Milestones/Activities**

- ◆ Surface point techniques:
  - **FY01      Feasibility test of inorganic binders at 1000C**
  - **FY02      Multi-functional thin film sensor array demo**
- ◆ Planar optical techniques:
  - **FY03      Temperature sensing “smart” particle demo at 1000C**
  - **FY04      Multiplexed fiber optic velocimetry demo**
- ◆ Prioritized list of Activities
  - **Develop and demonstrate surface heat flux measurements**
  - **Develop and demonstrate surface temperature measurements**
  - **Develop and demonstrate gas velocity measurements**